

CLAIMS

What is claimed is:

1. A structure comprising:

a substrate having a surface;

a plurality of elongated electrical conductors extending away from said surface;

said elongated electrical having a dielectric coating; and

each of said elongated electrical conductors having a first end affixed to said surface and a second end projecting away from said surface.

2. A structure according to claim 1, further including a coating of an electrically conductive material disposed on said dielectric coating.

3. A structure according to claim 1 wherein said dielectric coating is selected from the group consisting of polyimides, polyamide-imides, paralynes, polysiloxanes, epoxies, polyurathanes, perflorinated polymers, and polypropylenes.

4. A structure according to claim 2 wherein said coating of an electrically conductive material is selected from the group consisting of Cu, Au, Ag, Pt, Pd, Ni and combinations thereof.

5. A structure according to claim 2 further including means for electrically interconnecting said electrically conductive coating on at least a part of said plurality of elongated electrical conductors.

6. A structure according to claim 5 wherein said means for electrically interconnecting at least a part of said plurality of elongated electrical conductors is an electrically conductive coating disposed on at least a part of said surface.
7. A structure according to claim 6 wherein said electrically conductive coating on said plurality of elongated conductors and electrically coating on said surface are a substantially continuous coating.
8. A structure according to claim 7 wherein said substantially continuous coating is selected from the group consisting of a sputter deposited coating, a plasma deposited coating, an electrolytically deposited coating, an electrolessly deposited coating, and electrophoretically deposited coating.
9. A structure according to claim 1 further including a means for maintaining said plurality of said second ends in substantially fixed positions with respect to a reference position.
10. A structure according to claim 1 or 2 wherein said first end is affixed to said surface at an electrical contact location.
11. A structure according to claim 9 wherein said means for maintaining is a sheet or material having a plurality of openings therein through which said second ends project.
12. A structure according to claim 9 wherein said means for maintaining further including means for electrically interconnecting said electrically conductive coating on at least a part of said plurality of elongated electrical conductors.
13. A structure according to claim 1 wherein said second end has a protuberance thereat.

14. A structure according to claim 11 wherein said sheet is formed from a material selected from the group consisting of a rigid material and a compliant material.

15. A structure according to claim 11 wherein said sheet comprises a sheet of electrically conductive material having a plurality of through holes therein, said sheet of material contains a dielectric material to provide a means for preventing said elongated electrical conductors from electrically contacting said sheet of electrically conductive material.

16. A structure according to claim 11 wherein said sheet is spaced apart from said surface by a flexible support.

17. A structure according to claim 16 wherein said flexible support is selected from the group consisting of a spring and an elastomeric material.

18. A structure according to claim 1 wherein said elongated electrical conductors have a shape selected from the group consisting of linear, piece wise linear, curved and combinations thereof.

19. A structure according to claim 16 wherein said sheet and said flexible support form a space containing said plurality of elongated electrical conductors.

20. A structure according to claim 19 wherein said space is filled with a flexible material.

21. A structure according to claim 20 wherein said flexible material is an elastomeric material.

22. A structure according to claim 15 wherein said sheet has a top surface and a bottom surface and said through holes have a sidewall, said dielectric material

coats said top surface and said bottom surface and said sidewall.

23. A structure according to claim 1 wherein said plurality of elongated electrical conductors are distributed into a plurality of groups.

24. A structure according to claim 2 wherein said plurality of elongated electrical conductors are distributed into a plurality of groups.

25. A structure according to claim 23 wherein said plurality of groups are arranged in an array.

26. A structure according to claim 24 wherein said plurality of groups are arranged in an array.

27. A structure according to claim 1 wherein said structure is a probe for an electronic device.

28. A structure according to claim 27 wherein said electronic device is selected from the group consisting of an integrated circuit chip and a packaging substrate.

29. A structure according to claim 24 wherein each of said groups corresponds to an integrated circuit chip on a substrate containing a plurality of said integrated circuit chips.

30. A structure according to claim 29 wherein said substrate containing said plurality of integrated circuit chips is a wafer of said integrated circuit chips.

31. An apparatus for using said structure of claim 1 to test an electronic device comprising:

means for holding said structure of claim 1, means for retractable moving said

structure of claim 1 towards and away from said electronic device so that said second ends contact electrical contact locations on said electronic device, and

means for applying electrical signals to said elongated electrical conductors.

32. An apparatus for using said structure of claim 2 to test an electronic device comprising:

means for holding said structure of claim 2, means for retractable moving said structure of claim 2 towards and away from said electronic device so that said second ends contact electrical contact locations on said electronic device, and

means for applying electrical signals to said elongated electrical conductors.

33. A structure according to claim 1 or 2 wherein there is a protuberance at said second end.

34. A structure according to 11 wherein said sheet comprises a sheet of electrically conductive material having a plurality of first through holes therein, and a sheet of dielectric material having a plurality of second through holes therein, said first through holes are aligned with said second through holes, said first through holes have a smaller diameter than said second through holes to provide a means for preventing said elongated electrical conductors from electrically contacting said sheet of electrically conductive material.

35. A structure according to claim 34 wherein sheet or electrically conductive material has a first side and a second side, said sheet of dielectric material is disposed on either of said first side and said second side of said sheet of electrically conductive material.

36. A structure according to claim 34 where there is disposed on said first side

and said second side of said sheet of electrically conductive material a layer of said dielectric material.

37. A structure according to claim 11 wherein said sheet comprises a sheet of rigid material having a plurality of through holes therein, said sheet contains a dielectric material to provide a means for preventing said elongated electrical conductors from electrically contacting said sheet of rigid material.

38. A structure according to claim 11 wherein said sheet comprises a sheet of dielectric material having a plurality of through holes therein, said sheet contains a sheet of a rigid material disposed in contact with said sheet of dielectric material, said sheet of rigid material has an opening therein exposing a plurality of said through holes to provide a means for support of said dielectric material.

39. A structure according to claim 38 wherein said sheet is spaced apart from said surface by a flexible support, said sheet of rigid material is disposed on said flexible support.

40. A structure comprising:

a first fan out substrate having a first surface;

said first surface having a plurality of contact locations;

a plurality of ball bonds attached to said plurality of contact locations;

a plurality of wires extending outward from said ball bonds, away from said first surface on fan out substrate;

a plurality of ball shaped contacts on the ends of said plurality of wires;

a layer of dielectric material surrounding said plurality of wires without covering said ball shaped contacts on the ends of said wires.

41. A structure according to claim 40, wherein said fan out substrate is selected from the group consisting of multilayer ceramic substrates with thick film wiring, multilayer ceramic substrates with thin film wiring, metalized ceramic substrates with thin film wiring, epoxy glass laminate substrates with copper wiring and silicon substrates with thin film wiring.

42. A structure according to claim 40, further including a layer of electrically conductive material covering said dielectric material on said probes; said electrically conductive layer is electrically connected to a common plane on said first surface of the said fan out substrate.

43. A structure according to claim 40, further including a sheet of material having a controlled TCE with a plurality of openings corresponding to said plurality of wires; said sheet of material is supported at a plurality of locations by a preformed frame of compliant, elastic material and located between said sheet of material and said first surface of said fan out substrate.

44. A structure according to claim 43, further including a conductive material used to fill the space between said plurality of wires and the cavity formed by said sheet of material and said compliant frame; said conductive material is connected to a common ground plane on said first surface of said fan out substrate.

45. A structure according to claim 1 wherein said dielectric coating is disposed on said surface and on said elongated conductor, said elongated conductor has a second end which is not coated with said dielectric material.

46. A structure according to claim 45 further including an electrically conductive

layer disposed on said dielectric layer to substantially form an electrically interconnected electrically conducting shielding layer about said plurality of elongated electrical conductors.

47. A structure according to claim 1 wherein said elongated conductors have a surface, said dielectric material is disposed on said surface so that a second end of said elongated conductor is not coated; an electrically conductive material is disposed on said dielectric material to form a coaxial elongated electrical conductor having an outer electrical conductor; further including an electrically conductive layer disposed on said dielectric material; an electrically conductive material is disposed between said coated elongated electrical conductors providing a common electrical connection between said outer electrical conductor on each of said coated elongated electrical conductors.

48. A structure according to claim 2 further including a means for electrically interconnecting said electrically conductive coatings.

49. A method comprising providing a substrate having a surface;

providing a plurality of elongated electrical conductors each having a first end and a second end;

bonding each of said first ends to said surface so that said second ends are disposed away from said surface;

forming a dielectric coating on said elongated electrical conductors.

50. A method according to claim 49 further including forming a coating of an electrically conductive material on said dielectric coating.

51. A method comprising:



providing a substrate having a surface, said surface having a plurality of elongated electrical conductors each having a first end and a second end, each a said first ends being affixed to said surface, each of said second ends being disposed away from said surface;

coating said second ends with a first material leaving an uncoated portion of said plurality of elongated conductors;

coating said elongated conductors with a dielectric material.

52. A method according to claim 51 further including disposing on said dielectric material a layer of electrically conductive material.

53. A method according to claim 52 wherein said layer of electrically conductive material is deposited by a method selected from the group consisting of electroless plating, electrolytic plating, electrophoretic deposition and sputtering.

54. A method according to claim 53 further including removing said first material to expose said elongated conductor at said second end.

55. A method comprising:

providing a substrate having a surface, said surface having a plurality of elongated electrical conductors each having a first end and a second end, each a said first ends being affixed to said surface, each of said second ends being disposed away from said surface;

disposing said substrate in a container containing a solution so that said second ends are not disposed in said solution;

said solution being a solution from which a dielectric material can be electrochemically deposited onto an electrically biased surface;

applying an electrical bias to said plurality of elongated electrical conductors to dispose on that portion of each of said elongated electrical conductors emerged in said solution a dielectric coating.

56. A method according to claim 55 further including disposing said substrate in a second solution from which an electrically conductive material can be electrochemically deposited so that said dielectric coating is emerged in said second solution, applying a bias to said elongated electrical conductors to coat said dielectric material with an electrically conductive material.

57. A method according to claim 55 wherein said dielectric material is an electroactive material.

58. A method comprising:

providing a substrate having a surface, said surface having a plurality of elongated electrical conductors each having a first end and a second end, each a said first ends being affixed to said surface, each of said second ends being disposed away from said surface;

coating said second ends with a first material leaving an uncoated portion of said plurality of elongated conductors;

disposing said substrate in a container containing a solution;

said solution being a solution from which a dielectric material can be electrochemically deposited onto an electrically biased surface;

applying an electrical bias to said plurality of elongated electrical conductors to dispose on that portion of each of said elongated electrical conductors emerged in said solution a dielectric coating.

59. A method according to claim 58 further including disposing said substrate in a second solution from which an electrically conductive material can be electrochemically deposited so that said dielectric coating is emersed in said second solution, applying a bias to said elongated electrical conductors to coat said dielectric material with an electrically conductive material.

60. A method according to claim 59 further including removing said first material to expose said elongated conductor at said second end.

61. A structure comprising:

a substrate having a surface;

a plurality of elongated electrical conductors extending away from said surface;

each of said elongated electrical conductors having a first end affixed to said surface and a second end projecting away from said surface.

said elongated electrical conductor having a dielectric coating disposed thereon so that said second end is not coated with said dielectric coating;

a coating of an electrically conductive material disposed on said dielectric coating and on said surface to form a plurality of coaxial elongated electrical conductors having electrically common outer conductors .

62. A structure comprising:

a substrate having a surface;

a plurality of elongated electrical conductors extending away from said surface;

each of said elongated electrical conductors having a first end affixed to said surface and a second end projecting away from said surface.

said elongated electrical conductor having a dielectric coating disposed thereon so that said second end is not coated with said dielectric coating;

a sheet of material having a plurality of through-holes therein;

said sheet of material is disposed so that said second ends extend through said through-holes;

a coating of a first electrically conductive material disposed on said dielectric coating;

said sheet of material comprising a second electrically conductive material;

said first electrically conductive material disposed on said dielectric coating being being electrically connected to said second electrically conductive material.

63. A structure comprising:

a surface having a plurality of electrical contact locations thereon;

a plurality of elongated coaxial electrical conductors each having a center conductor and an outer conductor, said center conductor has a first end and a second end,

said first end is affixed to one of said plurality of electrical contact locations, said second end projects away therefrom;

means for electrically interconnecting said outer conductors of at least a portion

of said plurality of said elongated coaxial electrical conductors.

64. A structure comprising:

a substrate having a surface;

a plurality of elongated electrical conductors extending away from said surface;

each of said elongated electrical conductors having a first end affixed to said surface and a second end projecting away from said surface.

said elongated electrical conductor having a dielectric coating disposed thereon so that said second end is not coated with said dielectric coating;

a coating of an electrically conductive material disposed on said dielectric coating to form a plurality of coaxial elongated electrical conductors; having electrically common outer conductors; and

an electrically conductive material disposed between coaxial elongated electrically conductors providing a common electrical connection between said outer conductors.

65. A structure comprising:

a substrate having a surface;

a three dimensional arrangement of electrical conductors disposed on said surface;

said three dimensional arrangement of conductor having a dielectric coating disposed thereon;

a coating of an electrically conductive material disposed on said dielectric coating to form a three dimensional arrangement of coaxial elongated electrical conductors having electrically common outer conductors; and

a material disposed between said three dimensional arrangement of coaxial electrical conductors.